# ENVIRONMENTAL BENEFITS OF BEDSIDE IONIC NITRIC OXIDE GENERATION

**In this article, David Webster, Chief Commercial Officer, and Mark Rimkus, Vice-President Clinical Affairs, both at Beyond Air, consider the environmental impact of traditional high-pressure storage systems for nitric oxide and highlight the benefits associated with bedside ionic generation.**

Nitric oxide (NO) has long been recognised for its therapeutic potential, particularly in respiratory care for conditions such as pulmonary hypertension and neonatal asphyxia. Traditionally, NO is generated industrially, stored in high-pressure cylinders and transported to healthcare settings. This process, while effective, poses environmental challenges related to production, transportation and storage hazards. Recent advancements in technology have enabled the bedside generation of inhaled NO using ionic chambers, which extract nitrogen from room air.

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## TRADITIONAL NO GENERATION

### Industrial Generation

Commercially, NO is produced by heating ammonium nitrate to a temperature of 245–270°C. This process creates several compounds, including NO, ammonia nitrogen, nitrogen and nitric acid, all of which contribute to the Earth's greenhouse gas burden. Additionally, the transport of high-pressure cylinders requires an extensive amount of energy, resulting in a carbon footprint associated with logistics and transportation. Finally, the disposal of high-pressure tanks can have significant environmental impacts, including gas emissions, safety hazards, material waste and chemical contamination.

### High-Pressure Cylinder Storage

Storing NO in high-pressure cylinders presents environmental risks such as potential leaks or explosions, which can lead to air pollution and other hazardous situations. The disposal of these cylinders also poses challenges, where improper handling can introduce toxic materials into the environment.

## BEDSIDE GENERATION OF NO WITH IONIC CHAMBERS

### Process Overview

Ionic chambers generate NO by extracting nitrogen from ambient air and using electrochemical processes. This innovative technology not only produces NO on-demand at the bedside but also eliminates the need for bulky storage tanks.

There are several environmental advantages to the bedside ionic generation of NO, including a reduction in the carbon footprint. By generating NO from ambient air, bedside systems significantly reduce the reliance on fossil fuels for both production and transportation purposes, thereby lowering the $CO_2$ emissions associated with traditional methods.

The elimination of high-pressure tank manufacturing is another advantage. The environmental impact of manufacturing high-pressure cylinders, typically used for

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storing gases such as oxygen and nitrogen, arises from various stages, from raw material extraction to production processes and end-of-life disposal. While high-pressure cylinder manufacturing is essential for various industries, its environmental impact can be substantial, and efforts towards eliminating tanks where possible are essential to mitigate the associated emissions.

The implementation of bedside ionic generation alleviates the need for frequent transportation of high-pressure cylinders, thereby reducing logistics emissions and fostering a more efficient use of healthcare resources by minimising transportation needs.

The risk of environmental hazards is reduced with bedside ionic generation. The elimination of high-pressure storage reduces the risks associated with leaks and bursts, minimising the potential for contamination of hospital environments and the surrounding areas. In cases of fire, high-pressure cylinders are very dangerous to hospital staff and firefighters, irrespective of cylinder contents.

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Lastly, the use of ambient air for NO generation aligns with sustainability principles, as it uses readily available resources, leading to a reduction in the resource depletion associated with traditional manufacturing processes.

## CONCLUSION

The shift from traditional industrial generation of NO to bedside generation using ionic chambers offers significant environmental benefits. The reduction in fossil fuel dependence, lower transportation emissions, decreased risk of hazards and enhanced sustainability all underscore the potential of this technology to promote a greener healthcare paradigm. As the medical community continues to prioritise environmentally friendly practices, the adoption of bedside NO generation could play a pivotal role in advancing public health while also respecting ecological health.

## ABOUT THE COMPANY

Beyond Air is a commercial-stage medical device and biopharmaceutical company dedicated to harnessing the power of endogenous and exogenous nitric oxide to improve the lives of patients suffering from respiratory illnesses, neurological disorders and solid tumours. The company has received US FDA approval for its first system, LungFit® PH, for the treatment of term and near-term neonates with hypoxic respiratory failure.

## ABOUT THE AUTHORS

**David Webster** joined Beyond Air as Chief Commercial Officer in July 2024, bringing extensive life sciences experience. He has successfully led multiple programmes through clinical development, regulatory approvals and global commercialisation. Before Beyond Air, he was Chief Executive Officer of Body Vision Medical, where he led the global launch of the Lung Vision system for diagnosing and treating endoluminal cancer. Mr Webster also spent 18 years at NeuroLogica, overseeing its acquisition by Samsung Electronics, later serving as Chief Medical Officer and Chief Operating Officer for Samsung NeuroLogica.

**Mark Rimkus** joined Beyond Air in February 2018 as Vice President of Clinical Affairs. He brings 32 years of experience as a Registered Respiratory Therapist and 15 years as a Professional Engineer. His career includes several years as a full-time respiratory therapist in neonatal and paediatric intensive care units, as well as working as a biomedical engineer in the healthcare industry. Mr Rimkus has also managed ventilator fleets, ABG analysers and NO delivery systems at a large hospital in Alberta, Canada, where he also tested new respiratory equipment.